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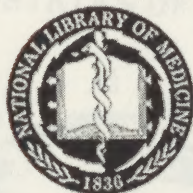


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DEPARTMENT OF THE ARMY

COLD INJURIES

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Cold Injury

MEDICAL STATISTICS DIVISION

MEDCS

21 October 1946

MEMORANDUM FOR: LT. COLONEL JOHN W. REGAN
Environmental Sanitation Branch
Preventive Medicine Division
Room 2D283

SUBJECT: Reply to Memorandum of Quartermaster General Concerning
Incidence of Foot Conditions.

The attached memorandum is forwarded as a reply to the memorandum of The Quartermaster General which requested that he be furnished with all available statistics on the disposition of Athlete's Foot and Trench Foot as these conditions occurred among personnel of the Army. The memorandum is in the form of a covering letter with nine appendixes and various attachments. It has been possible, on the basis of the data currently available in this office, to go into some detail with regard to Trench Foot. However, since there was almost no information on foot conditions such as "Athlete's Foot", the data in Appendix 9 dealing with the incidence of such conditions during the year 1942 will have to suffice for at least the next six to nine months.

EUGENE L. HAMILTON
Chief, Medical
Statistics Division

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WAR DEPARTMENT
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QMD 710
(Diseases of the Foot)

8 July 1946.

SUBJECT: Prevalence of Foot Diseases.

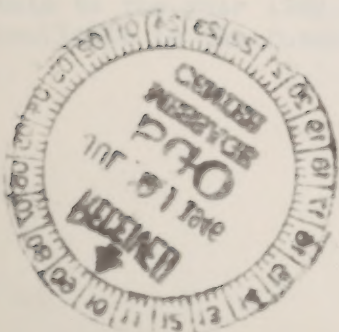
TO : The Surgeon General, Washington 25, D.C.

1. Request this office be furnished with all available statistics on the areal distribution of "Athlete's Foot" and Trench Foot as pertains to the Armed Forces of the United States, including, if possible, the number of man-hours lost due to these diseases and any material concerning the type and effectiveness of prophylactic measures taken.

2. Above information is required by the Environmental Protection Section of this organization, which, in conjunction with footgear studies, is making a study of the micro-climate of the foot in various parts of the world.

FOR THE QUARTERMASTER GENERAL:

W. H. MIDDLESMART
Brigadier General, QMC
Assistant



MEDCS

18 October 1946

SUBJECT: Incidence of Trauma of the Feet

1. In reply to OQMG memorandum QMGCD 710 (Diseases of the Foot), 8 July 1946 the following comments and attachments are forwarded.

2. During the war the army experienced five periods during which cold injuries of the feet were problems of varying importance. These are considered in detail in the first four appendixes attached to this memorandum.

3. At various times during the war this office published summary data in ASF Monthly Progress Report HEALTH on the incidence of cold injury among Army personnel. Photostatic reproductions of these are included as appendix 5. Statistical data which appear in other parts of this memorandum than Appendix 5 are to be considered more reliable than the similar data included in this appendix because they are more recent and revised.

4. Appendix 6 is a photostatic copy of a memorandum to The Surgeon General from the Information and Education Division, "Trench Foot Survey." The report summarizes the results of a survey conducted among trench foot patients at Camp Butner, North Carolina in April 1945. The survey was conducted in an attempt to discover some of the factors causing trench foot as seen by personnel who were affected.

5. Appendix 7, TB Med 81 and Change 1, "Trench Foot".

6. Appendix 8 includes copies of various letters and extracts of unit histories dealing with the subject of cold injuries of the feet.

7. No data are currently available concerning man days lost as the result of cold injuries of the feet.

8. Appendix 9 summarizes those data which are available concerning diseases of the feet such as trichophytosis, bromidrosis, etc. The data pertain to the year 1942. Incidence of these disease in later years will be available in the future.

EUGENE L. HAMILTON
Chief, Medical
Statistics Division

- APPENDIX 1. Incidence of Cold Injury During Attu Campaign
- APPENDIX 2. Cold Injury In The Mediterranean Theater
- APPENDIX 3. Cold Injury In The European Theater
- APPENDIX 4. Cold Injury In The Western Pacific
- APPENDIX 5. Photostatic Reproductions From HEALTH
- APPENDIX 6. Photostatic Copy of Memorandum to The Surgeon General
- APPENDIX 7. TB Med 81 and Change 1, "Trench Foot".
- APPENDIX 8. Copies of Letters and Extracts of Unit Histories
- APPENDIX 9. Data On Diseases Of The Feet

QUESTION 1. Indicate the value of the following expression.

ANSWER 1. The value is 100.

QUESTION 2. Solve the equation.

ANSWER 2. The solution is $x = 5$.

QUESTION 3. Calculate the area of the rectangle.

ANSWER 3. The area is 20 square units.

QUESTION 4. Find the perimeter of the triangle.

ANSWER 4. The perimeter is 30 units.

QUESTION 5. Simplify the expression.

- APPENDIX 1. Incidence of Cold Injury During Attu Campaign
- APPENDIX 2. Cold Injury In The Mediterranean Theater
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- APPENDIX 9. Data On Diseases Of The Foot

Appendix 1.

Incidence of Cold Injury During Attu Campaign

The outbreak of cold injury among American troops campaigning on Attu was the first instance of cold injury among U.S. personnel during World War II. The number of admissions for "exposure", principally footcases, was equivalent to about 31 percent of all casualties.

The Attu force consisted of 15,300 Army troops who required 22 days to complete the capture of the island. Various operation reports list the following casualties:

Summary of Casualties, Attu 11 May 1943 through 1 June 1943

Cause	Number of Admissions	Rate per 1,000 Men per day
All causes	3,829	11.4
Disease, Total	1,614	5.4
"Exposure"	1,200	3.6
Other	614	1.8
Nonbattle Injury	318	.9
Wounded	1,148	3.4
Killed	549	1.6

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The report of the force surgeon, dated 10 June 1943 includes the following comment pertinent to the cold injury experience on Attu:

Footgear "It is believed that the leather boots issued troops of this Landing Force were not properly constructed. The steel heel support was not carried high enough to prevent the boot breaking against the Achilles tendon and in many cases produced a severe traumatic tenosynovitis.

"The large number of casualties due to foot trouble were the result of damp feet added to cold and the inability of men pinned down in fox holes or other cover to keep up proper circulation by exercise. A waterproof type of foot gear would probably have prevented the occurrence of disability in many of these cases.

"The issue waterproof trousers were not of sufficiently durable material to remain waterproof more than a few days under the conditions of combat in the terrain encountered.

"The Alaskan field jacket and o.d. uniform with rain clothing are not considered adequate clothing for operations under the climatic and terrain conditions encountered.

"Sleeping Bag - The artic sleeping bag issued is not considered adequate for combat use because of its bulk and the fact that it is not waterproof. It is believed that a bag constructed as the inner portion of the bag issued but with a waterproof outer covering would be more suitable. Such a bag with small enough bulk to be carried into combat would permit warm dry rest which would prevent many cases of exposure especially the trench foot type. Boots could be removed and socks taken off and dried inside the bag by body heat."

Weather and Terrain "Tundra and steep snow-covered ridges made litter carries slow and exhausting work."

Description of Cases "The casualties listed in statistics as exposure are principally foot cases variously diagnosed as immersion foot, trench foot, and frost bite. While all three such conditions did occur, it is believed that the majority properly fall in the trench foot category. Many of the milder cases have already returned to duty. Moderate cases require 18 to 20 days before they are able to walk without pain. The more severe cases which it was believed would require more than three weeks hospital care were evacuated by ship."

Statistics on Exposure

Date	Admitted to Shore hospital	Evacuated to Ship	To Duty	Remaining
May 12	7	1		6
13	28	10		24
14	77	9	10	82
15	84	3	18	145
16	147		51	241
17	191	72	10	350
18	32	1	28	353
19	16		25	344
20	44		24	364
21	86		23	427
22	60	2	25	460
23	62	9	26	487
24	73	43	16	501
25	20	17	20	484
26	65	21	26	502
27	28	7	13	508
28	75	2	17	564
29	24		13	575
30	32		13	594
31	31	42	17	566
June 1	20		44	532
Total*	1,200	239	419	532

* There were a few cases after 1 June.

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A special study of a group of exposure cases evacuated to the 183rd Station Hospital mentions constant exposure to wet and snow with temperatures ranging between 30° and 40° Fahrenheit for the most part. Men went for days without relief and without having an opportunity to change their gear. Most men were not prepared for the experience, although some with special training apparently fared better. Constriction of boots was a common complaint. The high-top, leather, laced boot appears to have contributed to the development of trenchfoot under the conditions met on Attu.

Separate information on trench foot and frost bite is, unfortunately, not available, but the foregoing information suffices to reveal the general magnitude of the problem. Notable is the fact that one-third of the patients had been returned to duty by 1 June, a fairly high proportion suggesting that a good many of the cases were mild in degree. The following table summarizes the status of the exposure admissions on 1 June.

STATUS OF ADMISSIONS FOR EXPOSURE
As of 1 June 1943

Status	Number	Percent
Total admitted by 1 June	1,200	100.0
Returned to Duty	419	34.9
Evacuated to Ship	239	19.9
Remaining 1 June	532	44.3
Unaccounted for	10	.8

Source: — Report of Surgeon, Attu Task Force.

Appendix 2:

Cold Injury In The Mediterranean Theater

The outbreak of cold injuries of the feet which began in the Mediterranean in November 1943 was the first large scale epidemic of this condition. Although some attempt was made to differentiate between trench foot, immersion foot, and frost bite (ground type) in reporting, the differential diagnosis is perhaps more subjective than for other conditions and was complicated, perhaps to no small extent, by the fact that a diagnosis of frost-bite might entitle the soldier to a "Purple Heart" whereas diagnoses of immersion foot and trench foot would not.

The data on the incidence of these conditions are derived from the Medical Department current health report, the Statistical Health Report and the counts of admissions must be considered as preliminary.

Attachment a - Cold Injury Reported By The Mediterranean Theater.

Attachment b - Cold Injury and Wounded-In-Action Admissions For Fifth Army in Mediterranean.

COLD INJURY REPORTED BY THE MEDITERRANEAN THEATER*

Admissions and Rates Per 1,000 Men Per Year, By Months

		Cases	Rates per 1000 Men per year
1943	Nov	63	1
	Dec **	1148	20
1944	Jan	1385	29
	Feb	1596	34
	Mar **	867	14
	Apr	12	#
	May	--	--
	Jun **	--	--
	Jul	--	--
	Aug	--	--
	Sep **	--	--
	Oct	15	#
	Nov	373	6
	Dec **	372	6
1945	Jan	443	11
	Feb	346	9
	Mar **	133	3
	Apr	63	2
	May	11	#
	Jun **	3	#

- * Frost bite (ground-type), immersion foot, and trench foot
- ** Five-week periods. Unstarred months are four-week periods
- # Rates less than 0.5 per 1,000 men per year

APPENDIX 2
ATTACHMENT a

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**COLD INJURY AND WOUNDED-IN-ACTION ADMISSIONS
FOR
FIFTH ARMY IN MEDITERRANEAN**

Rates Per 1,000 Men Per Year, By Weeks

<u>Year and Week ending</u>	<u>Rates</u> <u>FIFTH ARMY 1943-4</u>		<u>Year and Week ending</u>	<u>Rates</u> <u>FIFTH ARMY 1944-5</u>	
	<u>Cold Injury</u>	<u>Wounded in-Action</u>		<u>Cold Injury</u>	<u>Wounded in-Action</u>
1943 Nov 5	1.3	224	1944 Oct 6	14.1	835.8
12	6.3	440	13	36.1	913.1
19	36.6	178	20	13.3	874.7
26	33.8	156	27	7.6	505.1
Dec 3	23.6	192	Nov 3	52.5	296.9
10	120.0	454	10	32.6	166.1
17	60.5	354	17	24.7	133.8
24	61.2	161	24	8.0	159.1
31	80.0	130	Dec 1	19.5	112.7
1944 Jan 7	141.0	435	8	19.2	78.8
14	99.8	215	15	17.6	110.2
21	73.9	185	22	22.9	80.8
28	47.5	431	29	36.0	70.2
Feb 4	29.9	516	1945 Jan 5	35.8	75.7
11	50.4	508	12	26.7	33.9
18	210.3	418	19	19.8	36.3
25	95.0	306	26	18.8	44.8
Mar 3	69.0	126	Feb 2	25.1	34.2
10	68.0	188	9	20.4	212.5
17	32.0	119	16	38.9	135.7
24	42.0	154	23	21.6	233.9
31	10.0	92	Mar 2	11.8	112.2
Apr 7	4.1	90	9	8.4	223.6
14	3.3	95	16	8.5	73.5
21	.88	104	23	2.7	45.8
28	2.5	153	30	2.6	36.8
May 6	.90	92.1	Apr 6	7.1	111.7
13	1.1	284.9	13	5.3	153.2
20	3.0	452.6	20	1.8	908.6
27	9.7	950.9	27	2.1	441.3
Jun 2	8.9	1219.0	May 4	--	175.4
9	4.3	507.1	11	0.3	16.6
16	.7	267.1			
23	.4	151.6			
30	.3	253.1			

Appendix 3.

Cold Injury In The European Theater

The attached tables contain the best data currently available on the incidence of cold injuries among ground force personnel in the European Theater. Data on all cases in the theater, suitable for the computation of theater rates are not available. However, the sum of the field armies must be at least 90 to 95 percent of all cases diagnosed in the theater.

- Attachment a - Cases of Cold Injury Reported By Field Armies in The European Theater
- Attachment b - Cold Injury and Wounded -In-Action Admissions for First Army in Europe
- Attachment c - Cold Injury And Wounded-In-Action Admissions For Third Army In Europe
- Attachment d - Cold Injury And Wounded-In-Action Admissions For Seventh Army In Europe
- Attachment e - Cold Injury And Wounded-In-Action Admissions For Ninth Army In Europe

CASES OF COLD INJURY REPORTED BY FIELD ARMIES IN THE EUROPEAN THEATER

Week Ending	Army					
	Total	First	Third	Seventh	Ninth	Fifteenth
1944 Nov 3	202	17	-	184	1	-
10	812	322	161	284	45	-
17	5363	1324	3356	585	98	-
24	2922	1052	1027	365	478	-
Dec 1	2427	598	903	465	461	-
8	1708	524	609	262	313	-
15	2914	1451	801	521	141	-
22	2729	1322	933	434	40	-
29	3141	1289	1060	554	238	-
1945 Jan 5	1682	605	444	556	77	-
12	3384	1487	924	815	64	94
19	3652	1664	1242	867	79	-
26	3313	1291	1016	974	32	-
Feb 2	2802	973	567	1188	73	1
9	2851	1622	327	795	107	-
16	1533	482	715	262	28	46
23	550	117	239	178	16	-
Mar 2	701	216	320	83	81	1
9	858	309	410	95	42	2
16	571	168	293	102	8	-
23	335	27	68	239	1	-
30	95	4	6	73	-	2

Source: Letter, Office of Chief Surgeon, ETOUSA to SGO Dated 28 March 1945,
Subject "Trench Foot."

**COLD INJURY AND WOUNDED-IN-ACTION ADMISSIONS FOR FIRST ARMY
IN EUROPE**

Rates per 1,000 Men Per Year, By Weeks

Year and Week ending	Cold Injury	<u>Rates</u>	Wounded in Action
1944 Nov 3	3.0		229
10	54.0		410
17	206.6		493
24	170.5		588
Dec 1	97.1		676
8	84.3		444
15	216.1		589
22	197.2		817
29	211.3		714
1945 Jan 5	99.6		485
12	241.9		481
19	271.2		757
26	205.6		419
Feb 2	167.7		446
9	339.9		362
16	85.2		203
23	19.5		159
Mar 2	35.3		609
9	50.7		653
16	27.6		555
23	4.5		415
30	0.7		354

**COLD INJURY AND WOUNDED-IN-ACTION ADMISSIONS FOR THIRD ARMY
IN EUROPE**

Rates Per 1,000 Men Per Year, By Weeks

Year and Week ending	Cold Injury	Wounded in Action
1944 Nov 3	-	91
10	35.2	611
17	752.4	1334
24	222.8	793
Dec 1	186.3	674
8	127.5	508
15	168.8	506
22	190.8	469
29	174.6	671
1945 Jan 5	68.8	704
12	141.9	895
19	184.6	733
26	149.3	462
Feb 2	90.9	297
9	56.8	504
16	124.2	471
23	41.7	513
Mar 2	57.7	836
9	70.1	559
16	49.4	454
23	11.0	411
30	1.0	350

**APPENDIX 3
ATTACHMENT 6**

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**COLD INJURY AND WOUNDED-IN-ACTION ADMISSIONS FOR SEVENTH ARMY
IN EUROPE**

Rates Per 1,000 Men Per Year, By Weeks

Year and Week ending	Cold Injury	Wounded in Action
1944 Nov 3	83.1	885
10	112.9	569
17	206.6	375
24	105.7	456
Dec 1	119.6	586
8	86.8	571
15	131.6	638
22	104.9	509
29	131.9	219
1945 Jan 5	126.9	383.8
12	179.1	529.7
19	141.4	632.4
26	187.6	381.5
Feb 2	207.2	418.8
9	132.1	367.7
16	49.5	157.8
23	34.3	275.0
Mar 2	16.5	162.7
9	18.4	205.0
16	17.0	446.8
23	39.8	552.9
30	12.2	285.7

APPENDIX 3
ATTACHMENT d

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COLD INJURY AND WOUNDED-IN-ACTION ADMISSIONS FOR NINTH ARMY IN EUROPE

Rates per 1,000 Men Per Year, By Weeks

Year and Week ending	Cold Injury	Wounded in Action
1944 Nov 3	0.3	324
10	12.4	179
17	27.8	366
24	130.2	999
Dec 1	125.7	634
8	83.6	310
15	40.4	97
22	10.5	233
29	74.0	221
1945 Jan 5	22.9	132
12	18.5	136
19	22.5	117
26	9.2	85
Feb 2	12.7	110
9	19.2	154
16	5.5	53
23	2.8	200
Mar 2	13.7	598
9	7.0	204
16	1.3	29
23	0.2	28
30	--	437

APPENDIX 3
ATTACHMENT a

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Appendix 4.

Cold Injury In The Western Pacific

These cases of injuries to the feet which occurred in the Western Pacific are not properly cold injuries because the men suffering from the conditions were not exposed to the requisite low temperatures. They are more properly immersion foot, and were mostly diagnosed during and directly after the latter phases of the campaign on Leyte in the Philippines. The cases resulted from the tactical situation which combined with the weather, forced many soldiers to spend much time in water-logged foxholes without much chance of drying out.

IMMERSION FOOT REPORTED BY THE WESTERN PACIFIC THEATER

Admissions and Rates Per 1,000 Men Per Year, By Months

	Cases	Rates per 1000 Men per year
1944 Dec **	167	2
1945 Jan	25	$\frac{1}{2}$
Feb	20	$\frac{1}{2}$
Mar **	7	$\frac{1}{2}$
Apr	2	$\frac{1}{2}$

** Five-week periods. Unstarred months are four-week periods

$\frac{1}{2}$ Rates less than 0.5 per 1,000 men per year

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Appendix 3.

The attached photostats, which are reproductions of pages of ASF Monthly Progress Report, "Health of The Army", contain the analyses of cold injuries which have been prepared in this office. They indicate the type of relationship between cold injury and battle, and contain discussions of possible preventive measures.

Attachment: Photostats of articles which appeared in ASF MPR, HEALTH.

Appendix 8.

Copies of letters and extracts of unit histories dealing with cold injuries of the feet.

- Attachment a. Memorandum For The Surgeon General dated 9 December 1944 and signed by Brigadier General F. W. Rankin, Subject: Trench Foot.
- Attachment b. Memorandum For Director Surgical Consultants Division and Director Medical Consultants Division dated 13 December 1944, signed by Lt. Col. R. H. Turner and Lt. Col M. E. DeBakey, Subject: Treatment of Trench Foot.
- Attachment c. Memorandum For The Surgeon General dated 19 June 1944 signed by Brigadier General Fred W. Rankin, Subject: Trench Foot.
- Attachment d. Cold Injury - 17th Airborne Division, ETO.
- Attachment e. Cold Injury - 28th Infantry Division.
- Attachment f. Cold Injury - 4th Armored Division.
- Attachment g. Cold Injury - 94th Infantry Division.
- Attachment h. Cold Injury - 36th Infantry Division.
- Attachment i. Cold Injury - 99th Infantry Division.
- Attachment j. Cold Injury - 35th Infantry Division, 1944.
- Attachment k. Trench Foot and Frostbite - 1st U.S. Infantry Division, 1945.
- Attachment l. Cold Injury - 35th Infantry Division, 1945.
- Attachment m. Trench Foot - 1st U.S. Infantry Division, 1944.

9 December 1944

MEMORANDUM FOR: The Surgeon General

SUBJECT: Trench Foot

1. In the report on the "Problem and Control of Trench Foot" which appeared in the June, 1944 issue of HEALTH and which was based upon the Army's experience with this condition in Italy last winter, the statement was made that, "A winter campaign in northwestern Europe could create a trench foot problem of major importance if the lesson of Italy were not heeded." This statement now assumes prophetic significance for a radio just received from E.T.O. it is reported that up to 28 November 1944 over eleven thousand cases of the condition have occurred among U. S. troops in that theater.

The early recognition by this office of the potential significance of injuries resulting from exposure to wet and cold is indicated in repeated memoranda on this subject, the first of which is dated 23 August 1943. In all of these memoranda great emphasis was placed upon the importance and relative efficacy of good prevention. Finally, in a memorandum dated 19 June 1944, in which a detailed analysis of the Army's unfortunate experience with this condition during last winter's Italian campaign indicated the inadequacy of our program of prophylaxis, it was recommended that "a vigorous program directed toward the prevention of trench foot along lines which have proved to be effective be inaugurated by this office" and that this should include:

- a. The dissemination of information to troops on the hazards of exposure to wet and cold and the careful instruction

of personnel in proper methods of prevention.

b. The provision of proper equipment and footgear for operations in wet, cold regions. Efforts should be directed toward assuring the efficacy of this equipment.

c. The direction of attention to unit commanders of the importance of foot discipline and of the diligent application of the protective measures.

d. The dissemination of information to Medical Department personnel concerning the most authoritative knowledge on first aid and definitive treatment.

3. In accordance with The Surgeon General's approval and direction all of these recommendations were carried out by this office to the extent possible within the limits of its authority, as indicated by the following:

a. A War Department Circular (No. 312, Sec. IV, 22 July 1944) was prepared, setting forth the essential principles of control and emphasizing the command responsibility for their application.

b. Information to Medical Department personnel concerning the most authoritative knowledge on the subject, including the most rational principles of prophylaxis and therepeusis was disseminated through articles published in THE BULLETIN of the U. S. ARMY MEDICAL DEPARTMENT (page 26, November 1943, and page 46, March 1944) and a War Department Technical Bulletin (TB MED 81, 4 August 1944).

c. Conferences were held with representatives of the Q.M.C. concerning provision of suitable equipment for troops when fighting in cold, water-cooked terrain. Recommendations were made to the Q.M.C. on

the proper type of heavy woolen socks and water-proof or water-resistant footgear.

4. It is apparent from these considerations that this office has long recognized the military significance of the trench foot problem. Citing the unfortunate experience with this condition last winter, it was strongly urged in June, 1944 that "steps should be taken to prevent its repetition." Accordingly, all the elements essential to an adequate control program were set forth by this office. However, the most important factor in assuring the success of this program is enforcement of these elements and this lies within the province of command rather than medical authority.

F. W. RANKIN,
Brigadier General, U. S. Army,
Chief Consultant in Surgery
Surgical Consultants Division.

13 December 1944.

MEMORANDUM FOR: Director, Surgical Consultants Division
Director, Medical Consultants Division

SUBJECT: Treatment of Trench Foot

1. In view of the certainty that Trench Foot will, in spite of preventive measures, be a major cause of ineffectiveness in combat troops in the E.T.O. during the present winter and may lead to prolonged invalidism and even permanent crippling in large numbers of soldiers, the undersigned submit the following comments on the treatment of Trench Foot.

2. Responsibility. Trench Foot is a condition for which both medical and surgical staffs have responsibilities. The experience in NATOUSA has indicated that the primary responsibility for treatment of Trench Foot may advantageously rest with the Medical Service. The greatest number of these cases occur under combat conditions that usually give high rates of battle wounds and the surgical service is likely to be more heavily burdened than the medical service. Advice and assistance of surgeons are needed in prevention and treatment of local infection and when amputations are required.

3. At present the accepted principles of treatment as authorized in TB Med 81 are conservative and consist essentially of rest, avoidance of local trauma and infection, elevation of the feet, and reduction of metabolism in the affected part by local cooling. This form of treatment was used extensively in NATOUSA last winter, but the results cannot be considered very satisfactory. It is generally recognized that a better form of therapy is highly desirable.

4. A form of therapy is hereby proposed that has rational basis and offers a possible means of checking the progression of the underlying pathologic process at an early stage and before tissue damage occurs. It is believed that this method of therapy, by preventing or cutting short the progression of the pathologic process either before it is fully developed or at the time of its inception, could provide a more rapid return of normal circulation and restoration of function and might well prevent the more serious complications including gangrene. It would thus have the advantages of returning a maximum number of soldiers to duty with a minimum number of days lost and a reduction of ultimate disability and deformity in the more seriously injured.

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5. In the light of these considerations, it is recommended that an early trial of the proposed method of therapy, the details of which are presented in the inclosure, be instituted.

R. H. TURNER,
Lieutenant Colonel, Medical Corps,
Medical Consultants Division.

W. E. DeBAVEY,
Lieutenant Colonel, Medical Corps,
Surgical Consultants Division.

Incl.

PROPOSED STUDY OF TREATMENT OF TRENCH FOOT

1. Pathogenesis. The primary pathologic process responsible for Trench Foot is vascular injury due to cold. Dampness is of importance mainly because it facilitates heat loss. At low temperatures tissues release a substance which initiates the process of sterile inflammation. Small blood vessels are injured in this inflammatory process and transudation of plasma through small vessel walls takes place. This transudate has a protein content of from 2.5 to 3.0 percent.

A feature of the adjustment of the body as a whole to chilling environment is reduction of blood flow to the extremities. Vasoconstriction in the extremities induced both reflexly and as a result of the direct action of cold is accentuated by inactivity of the individual. The combination of arteriolar vasoconstriction and small vessel injury and the resulting exudative process tends to cause anoxia and edema. There is good evidence that the most serious mechanism of local circulatory failure is blockage of capillaries, venules and larger vessels. This obstruction results from slow movement of blood in small vessels, rapid transudation of plasma through damaged vessel walls, and formation of columns of red cells of high viscosity, and finally actual clotting of the column of blood. While it is not definitely established whether the clumping of the red blood cells or "siltling" is due to loss of plasma into the tissues and stranding of the cells or to chemical colloid changes, it seems reasonable to state that the progression of this phenomenon with eventual clogging of the lumen leads to thrombosis. Once intravascular coagulation begins extension into adjacent channels tends to occur. Clotting of this stagnant column of concentrated blood is, therefore, the result of vascular inflammation and stasis. Information is not available concerning the coagulability of the blood of individuals with Trench Foot. Blockage of vessels has been demonstrated to be the cause of gangrene in Trench Foot and Frostbite. An excellent experimental study of injury to nerves by cold indicates that injury of vessels in the nerve and subsequent anoxia offers the best explanation for nerve injury. It is not known whether actual vascular obstruction by a clot is an important mode of injury to nerves in Trench Foot or whether more exudation and associated anoxia of the nerve is sufficient to produce the nerve injury seen in the condition.

The concept presented here is that Trench Foot is a condition characterized by a diffuse inflammatory process initiated by prolonged cold and in which the natural course of the inflammation is interrupted by occlusion of blood vessels.

One of the clinical features of Trench Foot is the difficulty in prognosis based on observations made at the time the patient first comes under medical observation. This fact is compatible with the concept that much of the harm may be due to progression of the pathologic process after the individual becomes a patient and therefore might be prevented by proper therapy.

2. Therapy. In accordance with this concept of the pathologic physiology of Trench Foot, three therapeutic measures are proposed that

seen to have rational basis and that, if experience justified, might be combined eventually into a single regimen. These three measures are:

1. Sympathetic Block
2. Pressure Dressings
3. Anticoagulant Therapy

These three measures are designed to counteract certain factors, the combined action of which produce the disturbed physiology and contribute to the progression of the resultant pathologic process. To be most effective, these measures must be instituted early, i.e., in the prehyperemic phase while vasoconstriction is still present and before transudation and thrombosis begin. Sympathetic block is used with the purpose of counteracting vasoconstriction and thus increasing blood flow. The pressure dressing is employed just as in burns, in which the pathologic process of a sterile inflammatory reaction is similar. The pressure dressing splints the part and thus diminishes local metabolic activity, increases tissue pressure and thus prevents edema by counteracting the transudation of intravascular fluids, and provides protection of the skin against infection. In this latter connection, invasive infection can be combatted by chemotherapy. The third and perhaps most important pillar supporting this method of therapy is the use of anticoagulants. This is designed to prevent thrombosis in the arterioles and smaller vessels, which is liable to occur as a result of the "siltling" or "stranding" phenomenon. Heparin is considered the agent of choice for this purpose because of its quick action. Injection of a suspension of heparin in Fitkin Menstruum would be advantageous because of its ease of administration and because the heparin concentration can be better controlled at the desired level.

It is recognized that this form of treatment has not been tried clinically but it has basis in experimental studies and the strong support of a rational concept of pathogenesis. The chances of harm from such therapy are minimal. Its clinical trial appears well justified and is strongly urged. However, it should be employed under well-controlled conditions by competent observers who are capable of making the necessary studies in its evaluation. It is also highly important that each of the three therapeutic measures be evaluated separately before efforts are made to combine them. Moreover, in view of the possibility that the prevention of thrombosis or its progression may be the most important single therapeutic objective, it seems highly desirable to determine the efficacy of this measure first by its use in alternate cases. This is particularly important since theoretically much of the value of the other two measures may depend upon the effectiveness of heparin in maintaining patency of the vessels. Once this has been determined, the value of heparin and one or the other therapeutic measure, or the combination of the three, may be ascertained. Under these circumstances and by the use of controlled studies the value of these three measures of therapy should soon become apparent.

19 June 1944

MEMORANDUM FOR: The Surgeon General

SUBJECT: Trench Foot

1. The Army's experience with trench foot during the past winter is considered highly unsatisfactory. This is based upon the following considerations:

a. Trench foot first appeared in the Fifth Army in Italy in November 1943. During the ensuing three months, December, 1943 and January and February 1944, the admissions were maintained at an exceedingly high rate, being on the order of about 60 to 90 per thousand men per year. Even in March 1944, this rate was still as high as 40 (see chart). A comparison of this experience with that of the British Expeditionary Forces in 1914-18 serves to emphasize the significance of these rates, for the B.E.F. is acknowledged to have suffered heavily from trench foot. The winter rates for the Fifth Army were about as high as the average 1914 B.E.F. rate, the highest of the war. An estimate for the Fifth Army during the year ending October 1944 yields a rate of 23 admissions per 1,000 men per year, about twice the British rates for 1916 and 1917 and almost as high as the average B.E.F. rate for the entire year (see chart). This high incidence of trench foot in the Fifth Army is further emphasized by the fact that, during the four months ending with March, it was one-fifth as great as the incidence of battle casualties.

b. Despite the fact that the British troops have been fighting in the same regions and under the same conditions as American troops, very few cases of trench foot have occurred among the British. According to the Surgeon in this Theater, "the primary cause for the difference" between the high incidence in American Troops and the low incidence in British troops appears to be:

- (1) Better foot discipline and training in care of the feet.
- (2) Heavy wool socks.
- (3) Shoes large enough so that no constriction of feet is caused by wearing heavy wool socks (U.S. troops tend to fit shoes too small for cold weather when heavy socks or two pairs of light socks must be worn).
- (4) A pair of clean dry socks for each man daily, issued with the ration
- (5) More frequent shifting of personnel in the line. (ETMD, NATOUA, 15 March 1944.)

c. These reasons given by the Theater Surgeon are strongly supported by the results of an interview and examination of 142 American soldiers with trench foot as they passed through the 109th Clearing Station. This revealed that:

- (1) With rare exceptions, the troops were not wearing heavy wool socks.
- (2) Troops have not been instructed in the proper care of the feet. One soldier had changed his socks three times in six weeks.
- (3) None of the soldiers questioned understood that foot trouble might result from resting in the cold, with wet shoes, socks, and feet.
- (4) None understood how to use overshoes to best advantage. (ETMD, NATOUA, 1 March 1944).

d. Despite these facts, the Fifth Army Surgeon reported on 1 March 1944, that "no solution has been found for the trench foot problem". In view of the above considerations and experiences in previous wars, this statement reflects an unjustifiably pessimistic attitude. In World War I, frost-bite and trench foot were important causes of disability in the British Army especially in the Dardanelles campaign and in France and Flanders. Early in these wars, there was little experience in handling these conditions but, in time, preventive measures were developed and stringently supervised by unit commanders. That proper prophylactic measures are highly effective and can practically eliminate the occurrence of the condition is demonstrated by the experience of the British in the last war. From December 1914 to February 1915, the weekly incidence of trench foot in the First Army was between 300 to 600 cases. However, "after strong disciplinary measures" had been taken to prevent its occurrence, "the disease became more or less negligible". This is demonstrated further by the sharp decline in the admission rate (see attached chart) after the first two winters on the Western front which has been attributed to the prophylactic program enforced by command. Thus, the average rate of 82 during 1914 fell to 38 in 1915, to almost 10 in 1916 and 1917, and to 4 in 1918 (see chart).

e. The significance which attaches to experience with and understanding of the disease may be illustrated by the observation of the Surgeon, NATOUA, that "whereas 3.7 percent of the infantrymen in the 3rd Infantry Division had been overseas only one month, over 30 percent of (sample) cases of trench foot were from this group. It is also significant that, although over 33 percent of the infantrymen in the 3rd Infantry Division had been overseas between one and two years, less than 1 percent of this group in our series developed trench foot". This is clear evidence that men with longer service overseas were far better prepared to protect themselves than were newly arrived replacements. Evidently also, such men may see action so quickly that only Z.I. training can be relied upon to give them the proper knowledge of prophylactic measures. One NATOUA Division Surgeon is quoted as saying, "I have never seen a new replacement in this theater who had received instruction in the prevention of trench foot prior to joining the division".

f. The contribution of trench foot to the non-effective rate is even more important than its contribution to the admission rate, further emphasizing the importance of prevention. Even a mild case may incapacitate a man for several weeks and serious cases are prone to secondary infection and to the development of gangrene, with the loss of toes or even a foot. This is exemplified by the fact that, in the British Expeditionary Forces in the last war, the average number of days in the hospital per patient was 38.6 for officers and 75.6 for other ranks. The recent experience in the Fifth Army is not much better. Only about 20% of the cases returned to duty in 3 to 6 weeks and the remaining 80% were evacuated to the Communications Zone. Moreover, of those returned to duty, about 10% had recurrences in about 6 weeks.

2. It is apparent from these considerations that the trench foot problem is important, that our recent experience has been far from satisfactory, and that steps should be taken to prevent its repetition. The reasons for our unfortunate experiences are quite apparent and consist essentially in the inadequacy of our program of prophylaxis. Primarily, it is due to inadequate instruction of personnel in methods of protection and the lack of provision of suitable equipment, especially shoes and socks. It must be recognized, however, that even after these measures have been met they must be put into effect by unit commanders, and personnel must apply them diligently if adequate protection is to be achieved. In the final analysis, this is a measure of discipline and the responsibility of unit commanders.

3. It is, therefore, recommended that a vigorous program directed toward the prevention of trench foot along lines which have proved to be effective be inaugurated by this office. This should include:

a. This dissemination of information to troops on the hazards of exposure to wet and cold and the careful instruction of personnel in proper methods of prevention.

b. The provision of proper equipment and footgear for operations in wet, cold regions. Efforts should be directed toward assuring the efficacy of this equipment.

c. The direction of attention to unit commanders of the importance of foot discipline and of the diligent application of the protective measures.

d. The dissemination of information to Medical Department personnel concerning the most authoritative knowledge on first aid and definitive treatment.

5. The potential significance of injuries resulting from exposure to wet and cold such as frostbite, trench foot, and immersion foot were early realized by this office and have been given serious consideration. In a memorandum prepared by this office dated 23 August 1943, Subject: "Revision in accordance

with modern concepts of military publications on the subject of injuries resulting from cold", a review of the current military publications on the subject was made and attention directed to their inadequacies. In a subsequent memorandum prepared by this office dated 16 October 1943, Subject: "Frostbite, immersion foot, and related conditions", there was presented the results of a survey which was made by this office to determine the scope of the problem as well as to obtain the most recent authoritative knowledge on the subject, with the view of ascertaining the need for further study and for preparing, coordinating, and disseminating the best information on the prophylaxis and therapeutics of these conditions. The literature on the subject of the effects of cold was reviewed and representatives of this office participated in conferences of a special committee of the National Research Council for the purpose of evaluating the problem, reviewing the most modern concepts of the pathologic physiology, and determining the best principles of prevention and treatment. On the basis of the review of the literature and reports from authoritative and experienced individuals on this subject, and on the basis of concepts formulated by this special committee of the National Research Council, articles which incorporate the most authentic knowledge on frostbite, immersion foot, trench foot, and related conditions, and the most rational principles of prophylaxis and therapeutics were prepared by this office and published in the BULLETIN of the U. S. ARMY MEDICAL DEPARTMENT. These articles also form the basis of revisions which have been prepared for the various training manuals in cooperation with the Training Division for this purpose. At the time of this survey, it was concluded in the memorandum dated 16 October 1943, that while these conditions were not serious at the time, they deserved serious consideration because of their potential significance. It was also pointed out that "the problem of adopting proper equipment for use in cold regions and the education of personnel in protection against hazards of exposure to cold is the one that deserves greatest emphasis".

FRED W. RANKIN,
Brigadier General, U. S. Army,
Director, Surgery Division

COLD INJURY - 17th Airborne Division, ETO

5a. "Climate and Geography":

The worst effect upon the health of the command has been the extreme cold under which combat has taken place. Twelve hundred and seventy-nine cases of frost bite occurred during the month. The leather boots worn by this command were not suited for long exposure to the very cold weather. Arctic shoes gave some added protection, but not enough. Care of the feet was stressed. Clean socks were supplied whenever possible. Men in front line positions were rotated when possible. However, under combat conditions the above edicts were not possible or were not practicable. It is believed that the new clothing being issued together with the fact that the students are becoming more experienced in caring for themselves in the cold under combat conditions, will materially lessen the frostbite casualties. Shoe pads, two pairs of wool socks, and inserts have been issued to approximately 85 per cent of the front line infantry troops, and shell leather gloves with wool fingers have been issued to approximately 2 per cent of the front line infantry troops.

Source: Monthly Sanitary Report - 17th Airborne Division - January 1945

COLD INJURY - 28th Infantry Division

1d. "In all units, warming stations are set up for those individuals continuously exposed to the weather.

4a. "Climate and Geography:

Troops have been operating in severe cold, deep snow, and mountain-our country. The biggest problem has been to secure adequate clothing and footgear. For this purpose the surgeon has worked closely with G-4 and for the most part this has been accomplished with the priority given to those troops required to be constantly exposed. Clothing is nearly adequate and wool scarfs and mittens have helped considerably. A hood of the Artic type is recommended for those soldiers on the line for open theaters. The most single serious condition is frostbitten feet.

Tracing these, it is found that reinforcements coming in without galoshes form the gratest number of casualties. Some come to the division with frostbitten feet and some develop it in the time required to put in a requisition and supply them. The canvas type Artic is not efficient as the all rubber type. A few kinds are efficient but great care is necessary to properly fit the men and instruct them in their use."

Source: Monthly Sanitary Report - 28th Infantry Division - January 1945

COLD INJURY - 4th Armored Division

"2. An unusual number of cases of Trench Foot were reported during the month. This was due to a number of causes, namely: (1) lack of overshoes; (2) weather characterized by continual cold and rain; (3) continual combat without an opportunity for the men to dry out and change wet clothing. Toward the latter part of the month sufficient overshoes were obtained to equip all troops. All troops were again instructed in the care of the feet and a dry change of footwear made available whenever possible. The incidence of Trench Foot has dropped appreciably. Mild cases of Trench Foot were treated at the reserve company of the medical battalion. Severe cases were evacuated to Evaluation Hospitals".

Source: Monthly Sanitary Report, 4th Armored Division, 4 December 1944

COLD INJURY - 94th Infantry Division

"During the first week of January, all elements of the 94th Infantry Division moved by motor and train convoy to the German Western Front from Brittany, France."

"The climatic conditions throughout the month have been marked with a continuous freezing temperature and snow from two (2) to twelve (12) inches deep. During the first week of the month, all elements of the command were convoyed to the western Front by rail and motor. This trip was made in crowded conditions and caused numerous cases of frost bite casualties. Troops that were in contact with the enemy suffered many casualties from frost bite and trench foot. Under severe fire, many troops were pinned down for periods of thirty-six (36) hours with only battle equipment. From these troops the majority of foot casualties have been taken. The physical and mental health of the troops has been excellent. The number of battle fatigue cases has been low, considering the type of warfare in which the troops have been engaged. Care of the sick and wounded has operated through normal channels. All cases requiring hospitalization have been transferred to field and evacuation hospitals serving this area. All troops have been provided with sleeping bags. A total of six thousand six hundred (6600) shoe packs have been issued to the front line troops during the last week of the month. All other troops, except those requiring non-tariff sizes, have been provided arctics. Clothing and housing of troops have been satisfactory."

Source: Monthly Sanitary Report, 94th Infantry Division, 1 February 1945

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COLD INJURY - 36th Infantry Division

"Trench foot was caused a serious loss of manpower within the Division during combat operations in the winter months in Italy and France due to the cold wet climates encountered. The highest incidents were reported during the months of January with 401 cases, February with 270 cases. November with 276 new and 97 recurrent cases and December with 155 new and 45 recurrent cases. During the month of November 77 cases of trench foot were received over a four day period from one Regiment of the Division that was attacking during a driving rain. These troops had been issued an extra pair of heavy wool socks and an extra light wool pair. Although most of them had shoe pacs they had four times as much trench foot as the rest of the Division. The other two Regiments of the Division were in a holding position and had a total of 19 cases of trench foot. Another observation of two adjoining companies under the same conditions of exposure was made when one company had 10 cases of trench foot over a six day period while the other company had 3 cases. It was found that the men of the company having 10 cases had had no change of light wool socks while those of the other company had dry socks exchanged 5 times. This was corrected. The marked decrease during the month of December is attributed to comparatively dry weather encountered during the month and to the educational program conducted during the months of October and November on foot hygiene and the prevention of trench foot. Shoe pacs were issued to the troops during the month of November with instructions for their proper wear and the importance of changing to dry clean socks and dry inner sole daily. Approximately 1700 men of this Division do not have shoe pacs or overshoes because of the lack of proper sizes in Quartermaster stocks. Every effort is being made to issue combat boots of sufficient size to permit wearing of heavy wool socks and a light wool pair. A system has been worked out by which the infantry S-4s replace the dirty socks with clean dry socks daily by sending the clean socks forward with the daily ration issue. The high casualty rate among Commissioned and Non-Commissioned Officers, resulting in frequent turnover of the command while in combat causes the necessary supervision of foot hygiene in small units and footgear discipline to be less efficient than is desired, even though constant attention is given to this matter in Battalion, Regimental and Division Headquarters. Instructions on prevention of trench foot given at the direction of Seventh Army to personnel of Replacement Depots and Convalescent Hospitals is believed to be an important aid in the educational program against the disease."

Source: Monthly Sanitary Report, 36th Infantry Division, 1 January 1945

COLD INJURY - 99th Infantry Division, 1st Army

"Climatic conditions continued adverse throughout most of the month. During the first half of the month, while the greater part of the command was committed, melting snow and continuous rain and mud contributed largely to the incidence of trench foot and frostbite.

The new type of winter combat clothing issued to front line troops late in January was not altogether satisfactory under the continuously wet weather conditions which prevailed. The shoe pacs, arctic socks, and water repellent trousers, failed to keep individuals dry who were continuously exposed to the weather. These deficiencies in clothing undoubtedly contributed to the high incidence of frost bite and trench foot during the first part of the month. It was the consensus of opinion of the regimental surgeons that combat boots with rubber arctic were more satisfactory than shoe pacs for the weather and terrain encountered. The main criticisms of the shoe pac were that the arch and counters gave inadequate support for marching, they were not waterproof and they contributed to an increased number of blisters due to difficulty in obtaining proper fits. Clothing was entirely adequate during the latter part of this month when the division was not in combat."

Source: Sanitary Report 99th Inf., 1st Army, February - 1945

COLD INJURY - 35th Infantry Division, 1944

On 8 November 1944 a new drive was begun in which the Division moved Eastward through Chateau Salins, Morhange, Putelange, Sarreguemines and across the Moselle River into Germany. Operations were handicapped during this period by the most adverse weather conditions of almost continuous rain and temperatures near freezing. The combat troops did not wear overshoes at the beginning of the offensive because it was felt they would handicap the rifleman and be lost in combat. However, the incidence of "Trench Foot" increased so rapidly that on 15 November 1944 the following preventative measures were instituted: 1. Overshoes were issued to all troops. When speed and mobility were demanded of infantry companies, the overshoes were stacked in company dumps. They were brought forward and redistributed to the men at the first opportunity. 2. Every effort was made by unit commanders to rotate troops daily, giving them an opportunity to warm their bodies, dry shoes and other clothing and obtain food and rest. 3. A clean dry pair of socks were issued daily when rations were brought forward. The dirty socks were returned by the messing detail to the service train area where they were collected by the supply sections and sent to the laundry. Clean, dry socks were pooled and from there sent forward daily as previously stated. 4. Soldiers were instructed to massage their feet for 5 minutes daily, not to wear tight shoes and socks or lace shoes and leggings tightly. 5. All new shoes received an application of dubbin at the unit supply sections before being issued and dubbin was reapplied by the individual soldier whenever the tactical situation permitted. The majority of soldiers shoes fit too snugly to permit the wearing of more than one pair of socks.

In view of our experience with Trench Foot in cold, wet weather from 8 November to 24 December 1944 I believe the following points should be considered when troops engaged in combat in cold, wet weather. The GI shoe and combat boot are not adequate protection against Trench Foot regardless of how much dubbin and impregnite are applied. Shoes as routinely fitted are too small to permit the wearing of more than one pair of heavy socks without constricting the foot. Shoes a full size larger than those ordinarily worn plus an artic for protection against moisture should be provided in the late fall. If possible footwear such as the shoepac should be issued in preference to the larger shoe and artic. It is also vitally important that troops be rotated in the front line so that men have a chance to warm their bodies, dry foot wear and clothing and secure food and rest. The 137th Infantry Regiment carried out a policy of troop rotation routinely and had as a result a low incidence of Trench Foot. They had a total of 72 cases of Trench Foot as compared to a total of 217 cases for the 134th Infantry Regiment and 226 cases for the 320th Infantry Regiment during the period 10 November to 24 December 1944. The results of rotation were so remarkable that the 137th Infantry Regiment was commended by the Commanding General of this Division as well as the Commanding General, Third US Army.

Source: 35th Infantry Division, 1944 Annual Report

TRENCH FOOT AND FROSTBITE - 1st U. S. Infantry Division, 1945

Although winter equipment and clothing were an item of issue for combat troops, it was not received by the combat personnel of the division until 23 January 1945. This issue was incomplete in that some individual sizes were unable to be properly filled. Items of issue were Shoe Pacs with 2 pairs of heavy wool socks and two pairs of inserts; Ponchos; Mittens with inserts; Mufflers; Cotton trousers; Snow Suits; and Snow Capes. Prior to the issue of this clothing and equipment many cases of frostbite especially of the feet occurred and it was not until after the issue of these items that a decrease in the number of cases was evident. During the month of January the division suffered 132 cases of Trench Foot and 212 cases of Frostbite. Only 7 cases of Trench Foot and 41 cases of Frostbite occurred after the issue of winter clothing and equipment. This same low rate continued during the month of February during which 20 cases of Trench Foot and 32 cases of Frostbite were reported. All of these were contracted during the first two weeks of the month and from that point on no case of Frostbite and only one case of Trench Foot developed in the division.

During this period of extreme cold weather and high incidence of foot cases maximum effort was made to instruct individuals in the care of hygiene of the feet and the prevention of Frostbite and Trench Foot. Within the combat units of the division certain facilities were provided for the men (heated tents or buildings) where they could go to change their wet clothing for dry and where their feet could be examined. In keeping with this program of prevention and in compliance with directives from higher headquarters Frostbite Non-commissioned Officers were appointed in the units to exercise control of this problem and a lecture was given to all of these non-commissioned officers on 23 February 1945 on the care of the feet and prevention of Frostbite and Trench Foot. One criticism to be made of this latter program was that it took place at a time when the problem had disappeared and the Frostbite Non-commissioned Officers as well as the enlisted personnel were not too receptive to a lecture which should have been prevented many weeks earlier when the problem was acute.

Source: 1st U. S. Infantry Division, APO 1, Semi-annual report of medical department activities 1945 - 28 July 1945

COLD INJURY - 35th Infantry Division, 1945

a. Ardennes Campaign. The 35th Infantry Division on 1 January 1945 remained heavily engaged with German Forces on the Southern flank of the German salient in the Ardennes Sector, generally in the vicinity of Marvie, Villers-La-Bonne-Eau and Sures. Our mission was to attack to the North and protect the East flank of the Southern corridor to Bastogne. Heavy casualties were incurred because of the intensity of combat, snow covered mountainous terrain and temperatures which ranged between 10° F to 20° F. Of particular interest was the number of cases of Frost Bite among the Casualties. Every effort was made to prevent Frost Bite by frequent rotation of troops, providing warming stations in defiladed areas immediately back of the front lines, wearing of adequate clothing, massage and exercise of the lower extremities, drying of socks and shoes and avoidance of constricting foot wear and clothing. We had been unable to secure shoe-pacs for our personnel. The Combat boots and overshoes being worn were inadequate protection against the cold for those in the front line whose movements were restricted, so a series of tests were made with available clothing and footwear to determine the best means of protection against Frost Bite. Paper worn between two (2) pair of socks or over 1 or 2 pair of socks was ineffective in keeping feet warm. Combat boots were not large enough to permit the wearing of more than two pair of thin wool socks without constriction of the feet. Overshoes worn over combat boots provided slight protection but were inadequate as proven by the fact that 60% of the Frost Bite casualties wore overshoes. The most satisfactory protection was obtained by wearing 6 or 8 pair of socks or a boot made out of 2 thicknesses of GI blanket inside of the overshoes. A foot so protected was kept warm, but it was difficult for soldiers to walk long distances. Our total losses in this Division from Frost Bite during the period 28 December 1944 to 17 January 1945 inclusive was 479. These casualties were incurred while the troops were heavily engaged with the enemy and frequently unable to move because of heavy enemy fire.

Source: 35th Infantry Division, ETO
1945-1st Semi Annual Report, 22 June 1945

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TRENCH FOOT - 1st U. S. Infantry Division, 1944

The first cases of Trench Foot in the division were reported the later part of October 1944. As mentioned above the climate at this time was cold and wet; bivouac areas were muddy and rainfall was very heavy. Overshoes were not available and men were unable in some cases to take proper care of their feet. It was not until the start of the attack toward the Roer River that Trench Foot began to occur regularly and show a gradual increase. Those conditions which predisposed to Trench Foot were present during this campaign. For the month of November, one hundred forty-nine (149) cases of Trench Foot were reported. In order to prevent its occurrence certain preventive measures were instituted and overshoes were requisitioned for the combat troops. Unfortunately, the issue of overshoes was unsatisfactory in that all large sizes were not available and at a much later date when overshoes did become available, they were of the canvas type which experience has shown were permeable to water. However, each man was instructed in the proper daily care of his feet, and made to understand how important this preventive care was. Each soldier was supplied with a minimum of five (5) pairs of socks; laundry service for socks was provided by the division quartermaster; "drying tents" were established at company level. The following is a directive issued to the troops on this subject.

Source: Annual Report of 1st U. S. Infantry Division, 1944

INCIDENCE OF SELECTED DISEASES OF THE FEET
AMONG U.S. ARMY PERSONNEL

Number of Admissions During 1942

	Total Army	U.S.	Total Foreign	L.A.	M.A.	ETO	North Africa	M.E.	CBI	Cp & SP	SNP	At Sea
Bromhidrosis	125	118	7	2	2	1	-	-	-	-	2	-
Callus	2374	1961	413	77	128	54	9	3	2	71	66	3
Clonus	413	340	73	13	23	16	-	1	1	14	5	1
Over-riding toes	90	79	11	2	-	2	-	-	-	7	-	-
Ballus Valgus	933	839	94	21	22	16	-	-	1	30	5	-
Hammer toe	913	839	74	13	13	11	1	-	-	21	16	-
Hyperhidrosis	372	324	48	10	9	10	-	2	-	11	6	-
Metatarsalgia	1625	1419	206	40	33	63	4	1	1	31	32	1
Trichophytosis of foot	25471	18127	7344	2544	661	399	89	117	201	2224	956	153
Pes Canus	729	670	59	3	11	16	-	-	1	20	9	-
Pes Planus	7764	6960	784	98	175	181	11	2	6	177	129	5
Tallipes	192	181	11	-	-	1	1	-	-	8	1	-
Loss of Part of Foot	21	21	-	-	-	-	-	-	-	-	-	-
Deformity of Foot	661	630	31	5	7	1	-	-	-	13	5	-
Promoted Foot	82	70	12	1	-	2	-	-	-	1	8	-
TOTAL	41765	32598	9167	2829	1084	771	115	126	213	2626	1238	163

INCIDENCE OF SELECTED DISEASES OF THE FEET AMONG U.S. ARMY PERSONNEL

Rates per 1,000 Men Per Year, 1942

	Total Army	U.S.	Total Foreign	L.A.	M.A.	ETO	North Africa	M.E.	CBI	CP & SP	SMP	At Sea
Bromhidrosis	.04	.04	.01	.02	.02	.01	-	-	-	-	.03	-
Callositas	.73	.74	.71	.76	1.27	.65	.39	.50	.23	.47	.93	.07
Clanias	.13	.13	.12	.13	.23	.19	-	.17	.11	.09	.07	.02
Over-riding toes	.03	.03	.02	.02	-	.02	-	-	-	.05	-	-
Ballux Valgus	.29	.32	.16	.21	.22	.18	-	-	.11	.20	.07	-
Hammer toe	.23	.32	.13	.13	.13	.13	.04	-	-	.14	.21	-
Hyperhidrosis	.11	.12	.08	.10	.09	.12	-	.33	-	.07	.08	-
Metatarsalgia	.50	.53	.35	.39	.33	.76	.17	.17	.11	.21	.45	.02
Trichophytosis of foot	7.86	6.81	12.54	24.95	6.56	4.83	3.90	19.34	22.99	14.73	13.45	3.81
Pes Canus	.22	.25	.10	.03	.11	.19	-	-	.11	.13	.11	-
Pes Planus	2.39	2.63	1.34	.96	1.74	2.18	.48	.33	.69	1.17	1.81	.12
Talipes	.06	.07	.02	-	-	.01	.04	-	-	.05	.01	-
Loss of Part of Foot	.01	.01	-	-	-	-	-	-	-	-	-	-
Deformity of Foot	.20	.24	.05	.05	.07	.01	-	-	-	.09	.07	-
Promoted Foot	.03	.03	.02	.01	-	.02	-	-	-	.01	.11	-
TOTAL	12.38	12.27	15.65	27.76	10.77	9.29	5.02	20.84	24.35	17.41	17.38	4.04

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